EXPERIMENTAL INVESTIGATION AND CALCULATION OF ABSOLUTE EFFICIENCY OF γ-RAY DETECTION WITH HPGe-DETECTOR WITHIN 0.2 – 18.6 MEV ENERGY RANGE

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There have been performed experimental and calculation studies of absolute efficiency of γ-ray detection with GC 5019 HPGe-detector (CANBERRA). The work was carried out in connection and simultaneously with the differential cross sections (by angle) measurement of reactions of proton radiation capture on lightest nuclei (^{9}Be, ^{11}B, ^{16}O), conducted at the tandem electrostatic ion accelerator EGP-10. In the interval E_γ=0.2–3.56 MeV to perform the experiments the ^{137} Cs, ^{152}Eu, ^{228}Th reference gamma sources were employed along with the ^{56}Co source, produced at the accelerator's proton beam through ^{56}Fe(p,n) ^{56}Co reaction. Higher these energies γ-rays were used from the resonance reaction ^{27}Al(p,γ_2)^{28}Si* (4.617 MeV) at E_p=2.489 MeV and ^{11}B(p,γ_1) ^{12}C* (4.439 MeV) and ^{11}B(p,γ_{11}) ^{12}C* (15.11 MeV) reactions at E_p =2.54 and 2.091 MeV, respectively. The γ-ray sources were positioned at a distance of 127 mm from the detector crystal face surface. Before the detector a protective lead screen 5 mm thick was placed, and the detector itself was surrounded with a cylindrical lead protection, also 5 mm thick. To implement Monte Carlo simulations (by MCNP code) the detector crystal effective volume was determined, in which γ-ray were registered. It appeared on 10 % less than geometrical volume, as was the basis for introduction on all surface of a crystal of the dead layer equal 1 mm. With a certain indeterminancy of the data on the detector's core size taken into account, the obtained ratio, 1.05–1.07, of the calculated and experimental values of γ-ray detection efficiency in the full-energy peak can be considered as quite satisfactory. Physical processes are discussed that define γ-ray detection efficiency energy dependence.

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